*The 2nd Spitzer Conference: Infrared Diagnostics of Galaxy Evolution*
*ASP Conference Series, Vol. 381, ©2008*
*Ranga-Ram Chary, Harry I. Teplitz, Kartik Sheth, eds.*

# *Spitzer* Data at the NASA/IPAC Infrared Science Archive (IRSA)

Anastasia Alexov and John C. Good
*Infrared Processing and Analysis Center, California Institute of Technology, Mail Code 100-22, Pasadena, CA 91125*

**Abstract.**
The NASA/IPAC Infrared Science Archive (IRSA) curates and serves science data sets from NASA's infrared and submillimeter projects and missions, including IRAS, 2MASS, MSX, SWAS, ISO, IRTS and from the *Spitzer Space Telescope*. All Spitzer data can be accessed from IRSA's *Spitzer* mission page at: `http://irsa.ipac.caltech.edu/Missions/spitzer.html`

*Spitzer* Legacy Enhanced Products along with ancillary data are delivered in six month intervals starting from Fall 2004, until Fall 2006. IRSA continually ingests the *Spitzer* data and the ancillary data, and these data are made accessible through IRSA's query engines. Legacy products for the C2D, FEPS, GLIMPSE, GOODS, SINGS and SWIRE projects are accessible through a common interface `http://irsa.ipac.caltech.edu/applications/Atlas`. This engine returns the spatial footprints of observations and provides access to all flavors of released data sets, including, where appropriate, previews of image mosaics, 3-color image mosaics and spectra.

## 1. Accessing *Spitzer* Data at IRSA

The original Spitzer Legacy Science Program (Legacy I) is comprised of six projects selected by the SSC in November 2000 following a solicitation of proposals and competitive peer review. Their raw and pipeline-processed data enter the public domain immediately upon SSC processing and validation.

Table 1 lists the six Spitzer Legacy I programs. These six teams deliver "Enhanced Products" along with ancillary data in six month intervals starting from Fall 2004 (Data Release 1) until Fall 2006. These data are made available to the public, via HTTP, on a staging disk at the Spitzer Science Center (SSC). IRSA continually copies these public data and ingests them into the archive. The Legacy products as a whole are diverse; there are images, catalogs, spectra, data cubes, models, previews, documentation, associated files, etc. These data are accessible through the following search engines.

### 1.1. Spatial Searches on Legacy Data Sets

"Atlas" is a single CGI program which can be used to search any collection of data in a general and uniform manner. It can be used to access Spitzer Legacy Enhanced Products and Ancillary data using spatial queries through a common user interface. It returns spatial footprints of images and catalog sources, download links, and previews of images and spectra. Some of the Atlas interfaces to the Legacy data collections have "One-touch Quick Searches" which have predefined spatial search criteria, so the user only needs to click on one button to get a default set of results. The SINGS interface also contains Galaxy "Sum-

Table 1. Spitzer Legacy Data Collections at IRSA

| Name of Spitzer Legacy Program | Acronym |
|---|---|
| From Molecular Cores to Planet-Forming Disks | C2D |
| The Formation and Evolution of Planetary Systems: Placing Our Solar System in Contex | FEPS |
| Galactic Legacy Infrared Midplane Survey Extraordinaire | GLIMPSE |
| Great Observatories Origins Deep Survey | GOODS |
| The Spitzer Infrared Nearby Galaxies Survey | SINGS |
| Spitzer Wide-area InfraRed Extragalactic Survey | SWIRE |

mary Web Pages", which contain a montage of data links and previews for each galaxy. Atlas supports Spitzer data visualization and fusion with distributed data sets through access to OASIS, IRSA's data integration tool.

`http://irsa.ipac.caltech.edu/applications/Atlas`

### 1.2. Inventories of IRSA Holdings

RADAR is an inventory and data access service for navigating and exploring the infrared sky, including Spitzer Legacy data. For a target region, it returns inventories of IRSA's catalogs, images and spectra. It provides one-click retrieval of IRSA's science products and links to specific services for further data exploration. The service is accessible from:

`http://irsa.ipac.caltech.edu/applications/Radar`

### 1.3. General Catalog Searches

The Gator query engine builds general queries to astronomical catalogs archived at IRSA, from constraints entered in a web-based form. Gator serves catalogs released by GLIMPSE and SWIRE Legacy teams.

`http://irsa.ipac.caltech.edu/applications/Gator`

## 2. *Spitzer* Legacy Datasets at IRSA

Spitzer Legacy Enhanced Products are updated regularly; IRSA then integrates these datasets into the archive after each data release. Since data ingestion and integration can be quite lengthy for 6 data collections, IRSA makes the data available through HTTP from each of the six Atlas collection front pages. Once the data are ingested and made searchable, they are available in Atlas, RADAR and (for catalogs) Gator.

Table 1 list the Spitzer Legacy data collections at IRSA. Table 2 summarises these data; the middle column lists the version of the data release made available through the search engines at IRSA as of March 2006. Please note that the most recent data release is available for download from a web page. The data are released bi-annually, starting from Data Release 1 (DR1) in Fall 2004, Data Release 2 (DR2) in Spring 2005, and Data Release 3 (DR3) in Fall 2005. The final data release for the Legacy I datasets is expected to be in Fall 2006 (DR5).

Table 2. Legacy Image/Spectra Data Available as of March 2006

| Legacy Team | Version | Data Summary |
|---|---|---|
| C2D | DR1 | 13 (of 300+) objects |
| FEPS | DR1 | 33 (of 300+) objects |
| GLIMPSE | DR3 | IRAC images of entire survey, at two pixel scales |
| GOODS | DR2+DR3 | Spitzer North/South fields, Ancillary data |
| SINGS | DR2 | 25 (of 75) galaxies |
| SWIRE | DR2+DR3 | 49 square degrees, all 6 fields |

### 2.1. *Spitzer* Ancillary Data Sets

There are also a number of ancillary Spitzer data collections available at IRSA. These are ground-based observations which were done in support of Spitzer observation planning and proposal preparation. These data are of the First Look Survey (FLS) fields as well as the Lockman Hole. Table 3 lists the ancillary Spitzer data sets at IRSA. They are all available under the search engine Atlas and in the IRSA inventory service RADAR.

Table 3. Spitzer Ancillary Data Sets

| Name | Data Summary |
|---|---|
| Spitzer FLS – Ancillary VLA Data | 2 sq. deg of B-array at 1.4 GHz; 3500+ sources |
| Spitzer FLS – NOAO Extragalactic – R Data | 30 pointings KPNO 4m MOSAIC camera |
| Spitzer FLS – NOAO ELAIS N1 – R Data | 8 pointings KPNO 4m MOSAIC camera |
| Spitzer FLS – MMT/Hectospec Spectral Data | redshift, photometric and astrometric catalogs |
| 2MASS 6X Lockman Hole | 2400+ deep images; 6 sq degrees |

### 2.2. *Spitzer* Catalog Data at IRSA

Table 4 lists the Spitzer-related catalogs in Gator as of March 2006, of which there are three major groups: 1) The First Look Survey ancillary data from the MMT/Hectospec project, which contains astrometric, photometric and spectroscopic information on sources in this field; 2) GLIMPSE "Catalog" which contains 30 million highly reliable sources, and a GLIMPSE "Archive" of 48 million more complete but less reliable sources in the galactic plane; and 3) 24 SWIRE catalogs, totalling well over a million sources spread over the 6 SWIRE fields.

## 3. Public *Spitzer* Data

IRSA served Spitzer public data off the SSC staging location since its release in May 2004. In May 2005, the data available off the staging disk diverged from

Table 4. Spitzer Catalog Data at IRSA - as of March 2006

| Catalog Name in Gator | Number of Columns | Number of Rows (Sources) |
|---|---|---|
| FLS MMT/Hectospec Spectroscopic Catalog | 22 | 1,317 |
| FLS SDSS and MIPS Astrometric and Photometric Catalog | 34 | 7,722 |
| FLS SDSS Spectroscopic Catalog | 18 | 291 |
| GLIMPSE Spring '05 Catalog (highly reliable) | 64 | 30,252,689 |
| GLIMPSE Spring '05 Archive (more complete, less reliable) | 63 | 47,722,247 |
| SWIRE CDFS Region Fall '05 Spitzer Catalog | 156 | 221,535 |
| SWIRE CDFS Region 24$\mu$m Fall '05 Spitzer Catalog | 29 | 21,545 |
| SWIRE CDFS Region 70$\mu$m Fall '05 Spitzer Catalog | 14 | 949 |
| SWIRE CDFS Region 160$\mu$m Fall '05 Spitzer Catalog | 14 | 317 |
| SWIRE ELAIS N1 Region Spring '05 Spitzer Catalog | 156 | 282,711 |
| SWIRE ELAIS N1 Region 24$\mu$m Spring '05 Spitzer Catalog | 29 | 26,355 |
| SWIRE ELAIS N1 Region 70$\mu$m Spring '05 Spitzer Catalog | 14 | 1,323 |
| SWIRE ELAIS N1 Region 160$\mu$m Spring '05 Spitzer Catalog | 14 | 522 |
| SWIRE ELAIS N2 Region Spring '05 Spitzer Catalog | 156 | 126,056 |
| SWIRE ELAIS N2 Region 24$\mu$m Spring '05 Spitzer Catalog | 29 | 12,729 |
| SWIRE ELAIS N2 Region 70$\mu$m Spring '05 Spitzer Catalog | 14 | 626 |
| SWIRE ELAIS N2 Region 160$\mu$m Spring '05 Spitzer Catalog | 14 | 215 |
| SWIRE ELAIS S1 Region Fall '05 Spitzer Catalog | 146 | 186,059 |
| SWIRE ELAIS S1 Region 24$\mu$m Fall '05 Spitzer Catalog | 29 | 8,759 |
| SWIRE ELAIS S1 Region 70$\mu$m Fall '05 Spitzer Catalog | 14 | 409 |
| SWIRE ELAIS S1 Region 160$\mu$m Fall '05 Spitzer Catalog | 14 | 115 |
| SWIRE Lockman Region Spring '05 Spitzer Catalog | 151 | 323,044 |
| SWIRE Lockman Region 24$\mu$m Spring '05 Spitzer Catalog | 29 | 31,982 |
| SWIRE Lockman Region 70$\mu$m Spring '05 Spitzer Catalog | 14 | 1,393 |
| SWIRE Lockman Region 160$\mu$m Spring '05 Spitzer Catalog | 14 | 501 |
| SWIRE XMM_LSS Region Spring '05 Spitzer Catalog | 127 | 250,733 |
| SWIRE XMM_LSS Region 24$\mu$m Spring '05 Spitzer Catalog | 29 | 24,799 |
| SWIRE XMM_LSS Region 70$\mu$m Spring '05 Spitzer Catalog | 14 | 802 |
| SWIRE XMM_LSS Region 160$\mu$m Spring '05 Spitzer Catalog | 14 | 286 |

the data available in the Spitzer archive (through Leopard), which now included GO and GTO un-embargoed data. IRSA no longer replicates the staging area data, and is developing connectivity services to the full Spitzer Archive.

IRSA will serve the Spitzer Legacy II and III "Enhanced Products" in the same fashion as Legacy I.

**Acknowledgments.** This work is based [in part] on observations made with the Spitzer Space Telescope, which is operated by the Jet Propulsion Laboratory, California Institute of Technology under NASA contract 1407.